Development of a continuous measurement system for atmospheric N_2O and CO concentrations and its application to in-situ observation at Syowa Station, Antarctica

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Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are known as major anthropogenic greenhouse gases. Among them, N_2O is an important gas for climate change, because the infrared absorption effect is 200 times more than that of CO_2. In addition, since N_2O catalytically decomposes stratospheric ozone (O_3), it is concerned that N_2O becomes a major factor for the destruction of the ozone layer after the concentrations of atmospheric chlorofluorocarbons decreases in near future. Therefore, it is important to reveal the temporal and spatial variations the atmospheric N_2O concentration and to understand the cause of the variations quantitatively. Carbon monoxide (CO) is not considered as greenhouse gas generally, but atmospheric CO is closely related to the atmospheric CH_4 concentration through OH radicals, which are important reactant both with CH_4 and CO. Therefore, for a better understanding of the atmospheric CH_4 budget, it is necessary to reveal the variation of atmospheric CO precisely. Furthermore, CO is also a useful tracer for biomass burning and has an important role in the atmospheric chemistry.

In this study, we developed a new continuous observation system for atmospheric N_2O and CO concentrations based on an OA-ICOS (Off-Axis Integrated Cavity Output Spectroscopy) laser spectrometer (Los Gatos Research, model N_2O/CO r23) (Fig. 1). Repeatabilities for the N_2O and CO measurements are estimated to be 0.14 ppb and 0.09 ppb (one standard deviation), respectively. The system was installed at Syowa Station, Antarctica, and continuous observation started in January 2019. In this presentation, we will introduce the observation system, thus developed, and show the temporal variations in the N_2O and CO concentration observed at Syowa Station.

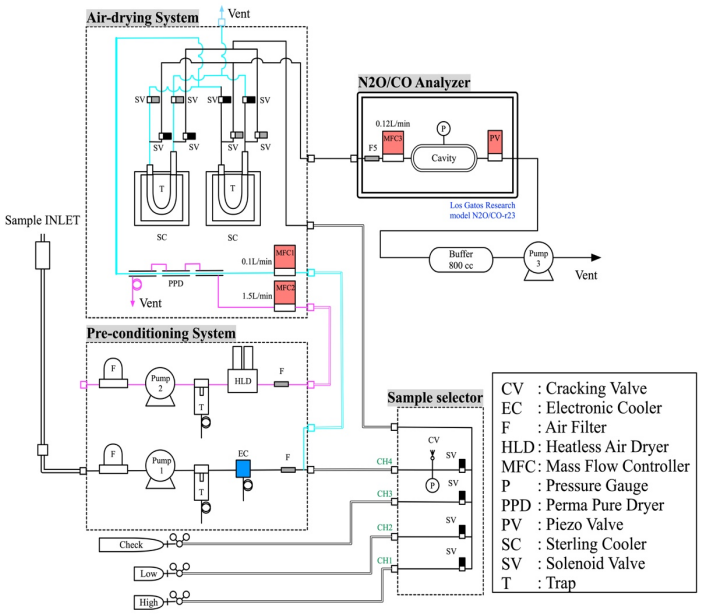

Figure 1. The continuous measurement system for atmospheric N_2O and CO concentrations installed at Syowa Station.

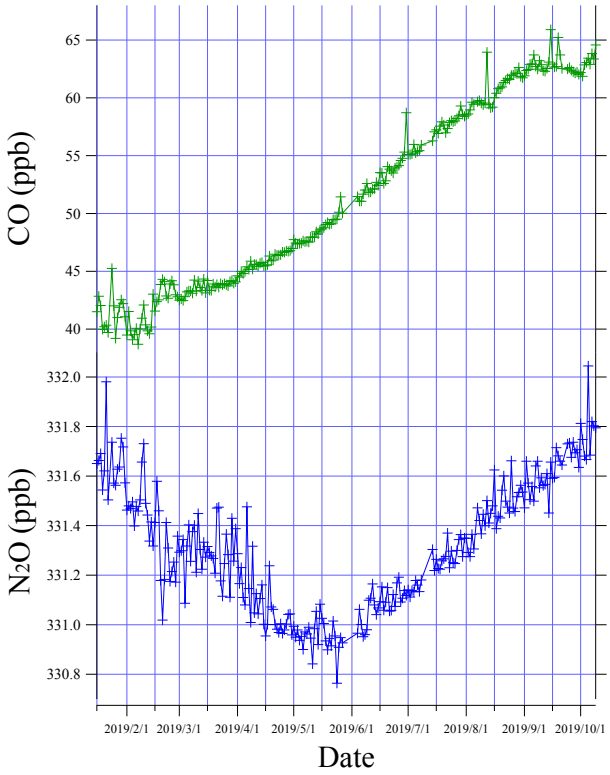

Figure 2. Daily mean concentrations of the atmospheric N_2O and CO observed at Syowa Station, for the period from 16 January to 9 October.